

II. "The Post-embryonic Development of *Julus terrestris*."

By F. G. HEATHCOTE, M.A. Communicated by ADAM SEDGWICK, F.R.S. Received November 16, 1887.

(Abstract.)

With regard to the development of the cœlom and generative organs, I have obtained the following results. The somites divide into two parts, as described for *Strongylosoma* by Metschnikoff, one part remaining in the body and the other part projecting into the legs. The cavities in these two parts together constitute the cœlom. The part within the legs breaks up and the cells give rise to muscles. The part within the body passes dorsalwards along the thin sheet of mesoblast which unites it to its fellow of the other side, so that the two vesicle-like parts meet above the nerve-cord in the middle line. They join so as to form a single tube, the generative tube. The young ova, as well as the follicle cells surrounding them, are formed by cells proliferated from the walls of this generative tube. The body parts of the somites of the antennæ and mandibles break up and disappear, but those of the third pair of appendages give rise to the pair of salivary glands. There are two pairs of somites to each double segment.

In the development of the nerve-system, I find that there are two cerebral grooves formed as in *Peripatus*. They disappear early in the development. The ventral nerve-system, which at first consists of two separate cords united by a thin median part, undergoes a process of concentration which results in the presence of a single stout cord showing slight traces of its former double condition. At an early period of development there is a cavity present in each ganglion. This cavity soon disappears, leaving no trace. Two ganglia are developed to each double segment.

The tracheæ are formed as epiblastic invaginations at the sides of and rather behind the legs. These invaginations swell out inside the body so as to form two vesicles, and as the development proceeds two diverticula are given off from each vesicle, one running beneath the nerve-cord to meet its fellow of the other side, the other running dorsally, parallel to the body-wall. Both these diverticula break up to form the tracheal tubes, the remaining part of the vesicle forming the tracheal pit. There are two pairs of these tracheal invaginations to each double segment.

The stink glands are formed as invaginations of the epiblast, and a second coat (muscular) is added later in the development. There is only one pair to each double segment.

The heart is formed from mesoblast cells in the body-cavity.

These cells which were directly derived from the hypoblast in the early stages of development, form a network in the body-cavity. The heart is the result of a joining together of the meshes of this network, and thus is formed by the confluence of a series of spaces in the mesoblast, and has nothing to do with the development of the coelom. The heart is placed in the middle dorsal line between the gut and the body-wall. It has two pairs of arteries leading into the spaces of the fat body in each double segment, and two pairs of ostia. The part of the body-cavity in which it lies is shut off from the rest of the body-cavity by an imperfect pericardial membrane which is continuous with the fat bodies. The tube of the heart is composed of three coats, an inner structureless membrane, a median muscular coat, the fibres of which are disposed circularly in alternate broad and narrow bands, and an outer connective tissue coat. The fat bodies are also formed from the same network of mesoblast cells which in this case secrete oil globules.

The body-cavity is a series of spaces between the gut and the body-wall, and is divided up by the mesoblast cells already referred to. It is distinct from the coelomic cavities of the somites, and is therefore a pseudocœle.

The eye-spots are all formed in the same manner. The hypodermis thickens and a cavity appears within it bounded by pigment. This cavity becomes a distinct vesicle. The front wall of the vesicle becomes very thin and furnishes the lens, while the cells of the back (*i.e.*, most internal) wall and sides become elongated and form the retinal elements of the eye. The nuclei of the front wall become very faint and finally disappear, while the rest of the vesicle remains continuous with the hypodermis of the body-wall. The cells of the vesicle are at first separate from the ganglion cells of the nerve-system, but a connexion takes place very early. A number of very small cells appear within the walls of the vesicle at a very early period, and I believe them to be derived from the mesoblast cells in the body-cavity, but of this I am not certain. They eventually become the pigment cells described by Grenacher.

The most striking feature of the development is the reduction of the ventral part of the young animal and the increase of the dorsal. In the just hatched animal the ventral region is nearly as large as the dorsal, and the legs are wide apart, having a distinct space between them. As development progresses the dorsal region is increased, while the ventral is contracted till the bases of the legs are close together. The corresponding concentration of the nerve-cord I have already mentioned. In a paper on *Euphoberia*, a Carboniferous Myriapod, Mr. Scudder points out that one of the principal points in which the genus differs from existing Diplopoda is the development of the ventral region. The relations of the dorsal and ventral regions

of the body of the *Euphoberia* correspond exactly to the condition of the young *Julus*.

With regard to the double segments of *Julus*, Newport held that each double segment corresponded to two segments originally distinct which had fused together; subsequent writers have held that each double segment is a single segment which has developed a second pair of legs. Now considering the double segments with regard to the development as well as to the adult condition, we see that the mesoblastic segmentation is double, so are the tracheal, the nervous, and circulatory systems. The only part of these double segments which is single is the dorsal plate with its stink glands which arise as invaginations in it; this dorsal plate being so enlarged as to form a complete ring round the body of the adult. Looking at the palæontology, we find that in the Archipolypoda, a family including the Archidesmidæ, Euphoberidæ and Archijulidæ, the dorsal plate did show distinct traces of a division. Therefore I think that each double segment represents two complete segments, the dorsal plates of which have fused together to make one plate.

III. "On the Sexual Cells and the early Stages in the Development of *Millepora plicata*." By SYDNEY J. HICKSON, M.A. Cantab., D.Sc. Lond., Fellow of Downing College, Cambridge. Communicated by Professor M. FOSTER, Sec. R.S. Received November 19, 1887.

(Abstract.)

The investigations were made upon several specimens of *Millepora plicata* I found growing in abundance on the fringing reefs of Talisse Island, N. Celebes.

The young sexual cells, both male and female, are found in the ectoderm of the cœnosarcal canals, between the dactylozooids and the gastrozooids.

At an early stage they leave the ectoderm, and by perforating the mesogloea take up a position in the endoderm.

The ova at an early stage become stalked. The stalk of the ovum, which is simply a modified pseudopodium, serves to keep the ovum attached to the mesogloea.

The stalk may at times be completely withdrawn, and the ovum by amœboid movements migrate along the lumen of the canal to a more favourable locality, where it becomes again attached to the mesogloea by a stalk.

Before maturation the germinal vesicle disappears, and a spindle-shaped body with longitudinal striæ appears, which throws out the first polar globule.